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TECHNICAL EDUCATION

IN

ELEMENTARY SCHOOLS.

Being a Paper read at the Birmingham Meeting of the British Association for the Advancement of Science, Sept., 1886; also at a Meeting of Delegates of the South Yorkshire District Co-operative Societies, at Masbro', Nov., 1886,

BY

PROF. W. RIPPER

(Of Sheffield).

APPENDIX I.—TEACHERS.
APPENDIX II.—DETAILS AND COST OF EQUIPMENT.

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TECHNICAL EDUCATION IN ELEMENTARY SCHOOLS.

HARRIS

Our attention has been frequently called of late to the importance of technical education, by which we mean a kind of education which has some direct bearing on the future employment of the scholars.

Now, the point of first and chief importance is that the children shall be educated—that is, that they shall be taught to think and act intelligently and to do justly.

In deciding suitable subjects of education, we cannot lose sight of those conditions of industrial life by which the children will be surrounded in the future, and we say that having given subjects of equal merit as a means of education and mental training, that subject is of most importance to the children which will be of most value to them in the future.

The children are going out to fill the workshops and factories, and we are led to ask, Can we not teach them while they are under the influence of the school something of those subjects which will be of practical use to them by-and-by in earning their daily bread?

Hitherto we have been endeavouring to train the intelligence of the children by attempting an early development of the power of abstract reasoning, and by cramming their little minds with unintelligible facts, the object in the schools being often not so much to educate as to pass a certain number at the annual examination. The contrast between such a system for young children and the more natural system of drawing out the intelligence through the exercise of the hand and the eye, as in the kindergarten method, is sufficient to make one wonder that we have been content to plod on in the old method so long.

We believe that a more practical and natural system of instruction is necessary throughout the schools, from the infant school upwards, and

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that the change would produce better results educationally and would result in a material gain to the children.

You will be aware that the compulsory subjects of the elementary schools are reading, writing, and arithmetic; in addition there are the class subjects—English, drawing, geography, history, and elementary science. If any subject is taught in addition to reading, writing, and arithmetic, it *must* be what the code calls "English." If there is time afterwards, other subjects may be taken.

I will give you, in the words of the code, what we are to understand by "English," which occupies so much of the time in our best schools.

For the highest classes this subject includes:—"The recitation of 150 lines from Milton or Shakspere, or some other standard author, and to explain the words and allusions. To parse and analyse simple, complex and compound sentences; to know the method of forming English nouns, adjectives, and verbs from each other, and to know the meaning and use of Latin prefixes in the formation of English words."

As a matter of fact, then, in our large manufacturing centres, you will find to-day the best energies of the teachers and children (when not engaged on the three R's), being expended on puzzling verbal distinctions, elaborate parsing of parts of speech, and the intricate analysis of complex and compound sentences, or on the cramming of long, dry lists of words, rules, and exceptions, which are no sooner learnt than forgotten, as is only too well understood by teachers and managers, who feel it a great hardship to have their annual examination fixed immediately after a three weeks' holiday. In other words, large grants of money are being expended in cramming the children with details which vanish from their minds like the morning dew before the sun. Now, what may be the motive of the Department and of their literary advisers for insisting so rigorously on the study of grammar by the children of our working-class population we do not know, but we think it should be remembered that a large number of intelligent parents are by no means satisfied that the children are spending their time to the best advantage.

I am reminded here of an advertisement which recently appeared in a newspaper, as follows:—"A father wants to find a school for his son, where a manly and useful education will be given him, and where the teachers do not fill the heads of their pupils with humbug stories about nations that died and were buried centuries ago, not a citizen of which could either command a steamboat, or manage a railway engine;" and this roughly expresses a sentiment which is by no means uncommon.

Except in degree, there is little or no progress in the teaching of the schools; there are the same traditional subjects of the old-fashioned "Commercial Academy" which our grandfathers attended before the days of machinery, railways, and the telegraph, and out of which our present system has grown.

The old-fashioned private school—as with the commercial or middle-class school of to-day—was attended by children who were meant for commercial life, for clerks in offices, banks, and warehouses. The children attending these schools were not from the ranks of artisans, nor were they intended to become skilled workers with their hands in factories; and yet the training which was thought to be the most suitable for clerkships, &c., fifty years ago, is perpetuated in our schools to-day and taken for granted to be the best training for the skilled workers of the future.

Now, I do not undervalue such studies, but all knowledge has a *relative* value, and we ask ourselves the question—Is the present system of public school instruction in any way suited to prepare the children attending the schools to take their part in the workshops of our great industries?—industries upon which the welfare of the nation depends, and which will grow and prosper in proportion to the intelligence, aptitude, and skill, brought to bear upon them.

We would ask—Is it more important that the children should know a lot of detail about regular and irregular verbs, moods, tenses, and voices, while they are taught nothing whatever of the elementary principles underlying the operations in which they are soon to be engaged, upon which so much depends, and of a knowledge of which their fathers feel day by day the need?

Again—Is all this more important than that they should acquire the power *to draw*, by which they may be able to appreciate correctness of form and beauty of design, an acquirement of supreme importance to all engaged in constructive work even of the humblest kind?—and yet no child may learn to draw who does not first learn what the code calls "English."

In proposing the introduction of elementary science or of any other subject in the schools, we are met with the reasonable objection that the curriculum is already an overcrowded one, and that it is impossible to squeeze anything more into it. This is undoubtedly true, and our first suggestion, therefore, is, that the excessive and useless detail which has been allowed to grow around the subjects of the code, should undergo a

useful pruning process; or, as an American writer puts it, "a little heroic surgery upon the swollen curriculum would be extremely healthful."

A large proportion of the children have, no doubt, as much as they can do during their school life to acquire the three R's, together with all that Her Majesty's Inspectors, from time to time, have understood the three R's to include, but there are children who have passed through the six standards, and who still remain at school for further instruction, and the number of such is annually increasing. By the last report of the Education Department the number of children in the schools who had passed Standard VI. was 21,416. These children represent the superior intelligence of the schools, and yet, at present, they receive, perhaps, the least attention; their number is too small to secure for them a special teacher; the large classes of juniors take all the best teaching; and at last they leave the school and go to work because "they have passed all the standards, and there is nothing more to learn." The Sheffield and Manchester School Boards have met the case by setting apart central schools for the special instruction of such scholars, and it is in these "higher grade" schools especially where it is desirable to consider the claims of technical instruction. Still, the great majority of the children in the ordinary school should receive some share of such instruction.

How, then, do we propose to make the school curriculum more practical?

By increased attention to the following subjects, viz.:—(1) Drawing, which should be made a compulsory class subject; (2) experimental instruction in science; (3) manual training in school workshops.

First, the introduction of a much more thorough course of instruction in drawing than anything hitherto attempted. You will be aware that the Royal Commissioners reported the great efforts which are being made on the continent to give universal instruction in drawing in the elementary schools, and to supplement this instruction by schools of art, furnished with the most perfect appliances, where industrial drawing and design are being taught free, in day and evening classes, which are attended by large numbers of students. Comparing this with our own country, so far as I know, we have not a school of art in England where drawing is taught free; and, with regard to the drawing in elementary schools, a member of the Commission recently said:—"We returned to this country to find that only 25 per cent of the children were being taught drawing, and even these were taught badly."

Efforts have since been made by the Education Department to remedy this state of things, but we regret to say with very unsatisfactory

results; the tendency of the recently-issued drawing regulations being to seriously diminish rather than increase the number of children under instruction; in other words, drawing is sacrificed in favour of exercises in the parsing and analysis of sentences.

If the instruction in "English" were made of practical use by being limited to the correction of provincialisms and common errors of speech, and drawing made a compulsory class subject, some valuable work would be done.

Happily, there are school boards, such as London and Birmingham, who have made independent efforts, and who intend to have the drawing thoroughly well done whether it "pays" as a grant-earning subject or not, and have appointed specially-qualified teachers for the purpose. The Sheffield and Manchester School Boards, and various private institutions, have special teachers, who devote all their time in giving instruction in geometry, machine construction and drawing, and building construction and drawing, with the most satisfactory results. The teaching of these subjects is greatly appreciated by the boys and their parents, and as a consequence the children are kept longer at school.

A gentleman recently sent his son to a steel works in Sheffield on trial for a month. He had not been there long when his master set him to make a working drawing, from a sketch, for a steel casting. The boy had been taught machine drawing at school, and to his employer's astonishment the drawing made was not only just what was wanted, but, as the manufacturer said, it was much superior to the drawings he had been in the habit of getting. This, of course, increased the value of the boy's labour at once, thanks to the instruction he received at school. And yet how few schools there are which send their pupils forth equipped in any such way.

A complete drawing scheme for schools should include freehand exercises; simple pattern designing; the more useful problems in plane geometry; plans, elevations, and sections of simple solids; easy examples in drawing to scale; introduction to the drawing of machine and building details, from actual examples giving dimensions.

Some complete course of drawing instruction such as this would confer an inestimable boon upon the children. It would combine the training of the mind, the hand, and the eye, and provide the children with a power capable of infinite application, and one which they could never lose. Drawing has the advantage, also, of being a very inexpensive subject of study.

Secondly.—Experimental instruction in science.

Up to the present science is almost unknown in the ordinary school. The Sheffield and Manchester School Boards provide a course of practical instruction in science to children in the higher standards at their central schools, very complete arrangements being made for the study of chemistry and machine drawing. Birmingham and Liverpool have a system which is specially recommended by the Education Department, namely, the instruction of the children by special teachers who attend the schools once or twice a week, and by the aid of simple apparatus they demonstrate by experiment the principles of mechanics, and illustrate the laws of health and other subjects. This plan has been carried out with marked success; the children are interested in their school work, their powers of observation are cultivated, they acquire information which no amount of mere book reading would give them, and they would rather miss any lesson during the week than the one with experiments in it.

As an educational agent, to say nothing of its practical value, the importance of such instruction cannot be over-estimated; and so far from its being a luxury, as has been contended by some, it is a necessity of the times in which we live. Its more general introduction would influence the everyday life and health of the people, and enable the future workman to reason intelligently upon the physical facts and phenomena by which he will be continually surrounded in the workshop, and the advantage would be reaped not by the children alone but by the whole community.

One of the signs of the times is the importance now attributed to practical science instruction in higher-grade schools, and the equipment of grammar schools with scientific apparatus and chemical laboratories. No one who has had an opportunity of noticing the intelligent interest taken by boys in the performance, with their own hands, of simple experiments, could fail to see that herein lies one of the secrets of successful education.

School laboratories have now become a necessary part of the equipment of a good higher school. The subject almost universally chosen for study in these laboratories is chemistry, probably because of its commercial as well as educational value. There are some disadvantages connected with it, such as the expense of material, and the unpleasant fumes, but these have not been sufficient to hinder its progress, as will be seen from the fact that, beside the number of pupils in grammar schools and colleges, no fewer than 6,139 presented themselves for examination in practical chemistry, under the Science and Art Department, in May last (1886).

There is, however, a future for mechanics and physics as suitable subjects for practical work in school laboratories. These subjects can be treated experimentally, with great advantage, and the cost of fittings and material is somewhat less than for chemistry, and much of the apparatus necessary could be made by the boys themselves in a school workshop.

Thirdly.—Manual instruction in school workshops for boys should occupy a similar place in the code to cookery for girls. Many who have followed me so far will draw the line here. A host of objections will at once suggest themselves, but I hope to show that there are many important reasons why we should introduce school workshops.

It has been charged against those who advocate manual training that they belong to that class which would deny the working man's child a liberal education; and that by introducing it we would perpetuate class distinctions. Nothing could be further from the actual facts. We say, let the education of every child in the United Kingdom be as thorough, as liberal, and, we would add, as useful as you can make it.

As to its perpetuating caste, we contend that the higher the grade of the school the more thorough should be the manual training, and we believe there are few things which would more effectually break down fashionable contempt of manual labour.

In presenting details for carrying out this work, much, of course, will depend upon the particular circumstances of the school, whether higher-grade or junior, whether in a manufacturing or an agricultural district. The following has reference more especially to good elementary schools in manufacturing districts:—

A good school workshop system should include—

1. A wood-working department, fitted with benches to accommodate twenty pupils, and supplied with the more ordinary wood-working tools, and a few wood-turning lathes.

This department is the one which it would be well most fully to develop, as the accomplishment of a piece of work in wood is more within the reach of boys than it would be in any other material.

To this may be added with much advantage

2. Metal-working department, containing benches to accommodate six pupils, fitted with vices, and supplied with hammers, chisels, and files, a small drilling machine, a smith's hearth and anvil, and other sundries.

The lathes used for wood-turning may be used also for light iron-turning. For estimate of cost, see appendix.

The course of instruction in these workshops should be purely educational, and the exercises therefore properly graded as in any other subject. There should be no idea of teaching any trade, nor of making articles for sale or profit.

The higher the grade of the school, the more complete should be its fittings, and the larger should be the number of pupils under manual instruction.

The workshop should not be put into the cellar, nor supplied with bad tools, as though anything or anywhere would do for it, but it should be dignified by giving it as good a room as is chosen for any other subject of the school course; and the tools and appliances should be as complete as the funds of the school will permit.

Above all, the teacher must be a man whose heart is in his work, and one who will create interest and enthusiasm among the pupils; accordingly he must not be the least intelligent, or the worst paid member of the staff. Better no workshop at all, than a cold, half-hearted instructor.

I have now to show why manual instruction is important.

After the Education Act of 1870 was passed, there were many among the working classes who reconciled themselves to sending their children to school in this way: they said, "Well, I have had to work hard enough myself, my children shall not work so hard if I can help it. They shall go to school and get an education, and then, perhaps, they will rise to be something better than their father is." The idea in the minds of many people was that education was going to save their children from hard work, and I believe there was a good deal of real disappointment when this was discovered to be a mistake.

Now, it is the opinion of not a few that the present educational system tends to create habits and tastes which may unfit the mind for the work before it, instead of fitting and aiding it. There is at present absolutely no sort of connection between the schoolroom and the workshop; between the present training and future employment of boys. Work, workshops, tools, materials, or workshop problems, are never mentioned in the school; they have no place here; all reference to these things is excluded as a sort of necessary evil which it will be time enough for the children to deal with when they are obliged. But the present grinding, aimless system of mere book learning and cram is not destined to live much longer in its present form. It encourages among the sharp, clever lads of the schools a disposition to leave the ranks of labour in which their fathers have

served before them, and to seek situations as clerks in offices; or, in fact, in any capacity where a black coat can be worn rather than a canvas jacket. These clever lads consider that whatever the backward boys in the class may be fit for, they at least are fit for something better than a "mere trade." They are conscious of skill with the pen, and of other office accomplishments; and they want and expect to find a market for these acquirements. On the other hand, they feel that they have no aptitude or desire for working with their hands, they have never used tools, and to learn a trade they would have to begin at the bottom, alongside lads who are educationally their inferiors.

Now, a system which is in danger of producing such results cannot be the one best suited to promote the true interests either of the children themselves or of the nation. There can be no greater fallacy than to imagine that any boy is too good for the workshop. Here is where brains are wanted; and if our elementary schools—the training ground of the artisans' children—are not helping to bring this about, to enlist talent on the side of skilled labour, we are not on the right course.

But in what way will manual training improve this condition of things? In this way. It will provide the connecting link between the theory of the school and the practice of the workshops, between books and tools, and between abstract rules and phrases, and the reality of things. It will teach the dignity of labour by example rather than by precept. It will help to form industrious, useful habits early in life, and give a taste for doing useful work with the hands which thousands never acquire. It will be a valuable relief from the sedentary, inactive life of the school, and so counteract the present tendency to develop a race of dyspeptic, pale-faced children, whose goal is passing examinations, and whose ambition is to be somebody's bookkeeper. It will cultivate a respect for the worker, and an appreciation of the worth of his work, by direct personal contact with it, whereby it will be discovered how much there is to learn in order to acquire the power possessed by the skilled handicraftsman. In addition to this, it will provide the boys with a positive power to work in wood and metals with more or less precision, which will be a valuable aid to many a lad who is destined, afterwards, to be thrown on his own resources in our large towns and cities, or in some of our far-off colonies.

The idea of manual training, though a comparatively new one with us, has made considerable progress, especially in France and America. In Paris most of the elementary schools are fitted with school-workshops—

some indeed very elaborately, and the teaching in them is quite free. During the month of September, 1886, an International Congress, with the view of giving additional impetus to the subject of technical instruction in all its grades, was held at Bordeaux. In America we are told "manual training is recognised not as a mere accessory, but as an indispensable department of education." The range of the schools into which it is being introduced, is from the most noted colleges and universities in the States to the public schools of small cities. In Sweden a thorough course of manual training is given in over six hundred of their schools.

In our own country we have a few institutions where manual training, as a subject for boys in day schools, has been taken up with great interest and success. Our present efforts, however, are but the small beginnings of a system which is destined to grow, and to occupy an important place in the educational methods of the future, the aim of which will be, while sacrificing none of the present advantages, to enable the schools to render more efficient help than in the past to the nation's industrial progress.

APPENDIX I.

TEACHERS.

The best teachers for all the subjects of the school course, whether technical or otherwise, are the professional trained teachers of the schools. These teachers could as easily acquire the power necessary to conduct practical workshop instruction, or to teach mechanical drawing, as they can acquire any other subject of the school curriculum, and the training colleges could easily provide the necessary instruction.

It is a matter for regret that more teachers do not prepare themselves to teach art or science, both pure and applied, as there is without doubt an increasing demand for such instruction.

The popular notion among young teachers leaving college is that the road *par excellence* to success in their profession is through the B.A. degree of the University of London. I would say to such, get the B.A. degree if you can do so without paying too heavy a price for it; but don't imagine that this is the only ladder by which you can climb to a sphere of greater usefulness. The teeming population of our industrial centres want men who will come among them, and give them useful information, which will help them and their children to do their daily work better; and they are willing to pay for it. Equip yourselves for the future by patiently mastering one or more subjects of importance to the present and pressing needs of the people, and rest assured that in due time your services will be in demand and your work appreciated.

Teachers with a taste for the study of art or science would do well to specialise their work in one of the following branches:—

Art.—Art teacher's certificate (*see* Art Directory).

Science I.—Chemistry—inorganic and organic, theoretical and practical.

Physics, including sound, light, heat, magnetism, and electricity.

Mathematics, stages 1, 2, 3.

II.—Machine and building drawing.

Workshop practice in wood and iron.

Practical plane and solid geometry.

Applied and theoretical mechanics.

Mathematics, stages 1, 2, 3.

III.—Animal physiology, physiography.

Hygiene.

APPENDIX II.

Details and cost of equipment of a school workshop to provide instruction in wood and iron work for twenty-six pupils working at one time. The same appliances may be used by any number of detachments:—

WOODWORK SHOP

To accommodate twenty pupils working at one time—

	£	s.	d.
10 benches, each 6ft. long, 2ft. 9½in. high, fitted with two wood vices, one on each opposite corner	17	10	0
Wood-working tools, including—			
20 jack-planes @ 3s. 2d.; 10 trying planes @ 4s.	5	3	4
10 smoothing planes @ 2s. 5d.; 1 plough, 13s. 8d.....	1	17	10
2 sets rebate planes (3 sizes) 1½in., 1in., ⅝in.....	0	10	4
6 sets chisels @ 4s. 9d.; 2 sets gouges @ 5s. 6d.....	1	19	6
6 ripper saws@ 3s. 8d.; 6 hand saws @ 3s. 5d.	2	2	6
10 tenon saws @ 2s. 9d.; 4 dovetail saws @ 2s. 7d. ..	1	17	10
2 sets mortice chisels @ 10s. 3d.; 2 sets mortice chisels, ¼in., ⅜in., ½in.	1	7	6
10 wood mallets @ 1s. 4d.; 1 doz. hammers @ 8d.....	1	1	4
6 mortice gauges @ 1s. 4d.; 2 doz. single-tooth gauges @ 6d.	1	0	0
1 doz. screwdrivers (assorted) @ 10d.; 1 doz. spoke-shaves @ 7d.	0	17	0
6 oilstones @ 1s. 9d.; 6 bevels @ 1s. 8d.	1	0	6
Squares: 3 12in., 4 6in., 20 4½in.	1	12	0
2 braces and bits @ 18s. 2d.; 20 wood rules @ 8d. ..	2	9	8
1 set match planes, 3 sizes (in pairs), ⅜in., ½in., ⅝in..	0	11	0
1 side filister for rebating	0	6	6
6 lathes for wood turning (may also be used for iron) @ £2.....	12	0	0
6 sets wood-turning tools @ 6s.	1	16	0
	£55	2	10

IRONWORK SHOP.

To accommodate six pupils working at one time—

	£	s.	d.
Bench accommodation for 6 vices, 5ft. apart; width, 2ft. 6in.; height, 2ft. 8in. (11 × 3 deal in front) 1 drawer to each vice	5	10	0
6 vices, 4in., @ 32s.	9	12	0
6 hammers @ 1s. 6d.; 2 doz. chisels, 12s.	1	1	0
Files—rough cut, second cut, and smooth	1	0	0
Squares, callipers, and compasses	1	0	0
1 small surface plate	0	12	0
1 hand drilling machine.....	2	0	0
1 small set of screwing tackle.....	1	9	0
1 smith's hearth and bellows	2	16	0
1 smith's anvil	1	0	0
1 set of sundry smith's tools	1	0	0
1 grindstone, trough, and hood	1	17	0
	£28	17	0

In a recent number of the *Contemporary Review* (November, 1886), Sir Philip Magnus contributes a very able article on "Manual Training," and in considering the cost to the country of introducing the subject, he says, "It would be necessary under any circumstances that the instruction should be encouraged by a system of grants, or by some equivalent external aid. . . . A grant of 4s. per head on the average number under instruction, as in the case of the cookery lessons, and the recognition of the subject by the Education Department, would afford sufficient encouragement to induce certain school boards and school managers to make manual training a part of the curriculum of the schools under their control. The total amount of these grants would be but a slight addition to our educational expenses.

"It may, I think, be asserted that the workshops being once equipped, the additional cost in grants of introducing handicraft teaching into the curriculum of our elementary schools would not exceed £5,000 a year, and for this comparatively small expenditure about 30,000 boys might be annually sent out into the world from our elementary schools endowed with practical skill at their fingers' ends, imbued with a taste and aptitude for the real work of their life, and so educated as to be able to apply to that work the results of scientific teaching and scientific methods."

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